

the one or more liners comprises one or more of boron, boron carbide, boron nitride, and cadmium.

28. The reactor of claim **21**, wherein the target material consists essentially of non-uranium material.

29. The reactor of claim **21**, wherein the target material comprises at least one of Molybdenum, Phosphorus, Sulfur, Iridium, Gold, Rhenium, and/or Chromium.

30. A method for producing isotopes within target material, the method comprising providing neutrons to target material within a uranium-comprising annulus, the target material consisting essentially of non-uranium material.

31. The method of claim **30** wherein the neutrons are provided to the target material within the uranium-comprising annulus to increase neutron flux within the annulus.

32. The method of claim **30** further comprising reflecting the neutrons to create a flux trap within the annulus.

33. The method of claim **30** further comprising filtering the neutrons as they are provided to the target material.

34. The method of claim **30** wherein the target material comprises one or more of:

P, S, Ir, Au, Re, Cr, and Mo;

the providing neutrons producing one or more of:

³²P, ³⁵S, ¹⁹²Ir, ¹⁹⁸Au, ¹⁸⁶Re, ⁵¹Cr, ⁹⁹Mo.

35. A method for modifying materials within target material, the method comprising providing neutrons to target material within a uranium-comprising annulus, the target material consisting essentially of non-uranium material.

36. A method for characterizing material within a target material, the method comprising providing filtered neutrons to the target material within a uranium-comprising annulus to activate the material for neutron activation analysis, the target material consisting essentially of non-uranium material.

37. A method for producing isotopes within a target material, the method comprising providing a neutron flux within a target assembly housing an annulus encompassing target material, the neutron flux being lower than that necessary to produce substantial amounts of isotope in another target assembly that does not house an annulus.

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